

CLAIMS

- 1 1. An optical system comprising:
  - 2 a substrate;
  - 3 a first optoelectronic element supported by the substrate;
  - 4 a first channel formed in the substrate; and
  - 5 a first heat transfer fluid arranged in the first channel, the first heat transfer
  - 6 fluid being thermally coupled with the first optoelectronic element such that at least a
  - 7 quantity of heat produced by the first optoelectronic element is dissipated by the first
  - 8 heat transfer fluid.
  
- 1 2. The optical system of claim 1, further comprising:
  - 2 a second optoelectronic element supported by the substrate; and
  - 3 wherein the first heat transfer fluid optically communicates with the first
  - 4 optoelectronic element and the second optoelectronic element such that the first heat
  - 5 transfer fluid can propagate optical signals between the first optoelectronic element
  - 6 and the second optoelectronic element.

1       3.     The optical system of claim 2, further comprising:  
2              a second channel formed in the substrate; and  
3              a second heat transfer fluid arranged in the second channel, the second heat  
4              transfer fluid being thermally coupled with the first optoelectronic element such that  
5              at least a quantity of heat produced by the first optoelectronic element is dissipated by  
6              the second heat transfer fluid.

1       4.     The optical system of claim 3, wherein the first heat transfer fluid is different  
2       than the second heat transfer fluid.

1       5.     The optical system of claim 3, wherein the second heat transfer fluid optically  
2       communicates with at least one of the first optoelectronic element and the second  
3       optoelectronic element.

1       6.     The optical system of claim 5, wherein the second optoelectronic element and  
2       the first optoelectronic element are operative to communicate with each other  
3       optically via the second heat transfer fluid.

1       7.     The optical system of claim 6, further comprising:  
2              first and second reflectors arranged in the first channel for directing optical  
3       signals between the first and second optoelectronic elements.

1    8.    The optical system of claim 6, wherein the portion of the substrate that defines  
2    the first channel exhibits a refractive index lower than a refractive index of the first  
3    heat transfer fluid such that the first channel operates as a waveguide for directing  
4    optical signals between the first and second optoelectronic elements.

1    9.    The optical system of claim 6, wherein the substrate is substantially planar and  
2    has an exterior surface;  
3        wherein the first channel is substantially U-shaped, with first and second ends  
4    of the first channel terminating at the exterior surface of the substrate; and  
5        wherein the first optoelectronic element optically couples with the first end of  
6    the first channel and the second optoelectronic element optically couples with the  
7    second end of the first channel .

1    10.   The optical system of claim 9, further comprising:  
2        a first reflector arranged in the first channel and optically communicating with  
3    the first optoelectronic element; and  
4        a second reflector arranged in the first channel and optically communicating  
5    with the second optoelectronic element, the first and second reflectors optically  
6    communicating with each other such that an optical signal propagated from the first  
7    optoelectronic element is reflected from the first reflector to the second reflector and  
8    directed to the second optoelectronic element.

1    11.    The optical system of claim 1, wherein the first heat transfer fluid is contained  
2    within the substrate.

1    12.    The optical system of claim 1, wherein the first heat transfer fluid is a liquid.

1    13.    The optical system of claim 1, further comprising:  
2              a recirculator fluidly communicating with the first heat transfer fluid, the  
3              recirculator being operative to move the first heat transfer fluid within the first  
4              channel.

1    14.    The optical system of claim 13, further comprising:  
2              means for removing heat from the first heat transfer fluid.

1    15.    The optical system of claim 13, further comprising:  
2              a heat exchanger fluidly communicating with the first heat transfer fluid, the  
3              heat exchanger being operative to remove heat from the first heat transfer fluid.

1    16.    The optical system of claim 1, further comprising:  
2              an input transmission medium optically communicating with the first heat  
3              transfer fluid; and  
4              an output transmission medium optically communicating with the first heat  
5              transfer fluid.

1    17. A method for cooling an optoelectronic element supported by a substrate, said  
2    method comprising:

3                providing a heat transfer fluid; and  
4                channeling the heat transfer fluid in the substrate to thermally couple with the  
5                optoelectronic element such that at least a quantity of heat produced by the  
6                optoelectronic element is dissipated via the heat transfer fluid.

1    18. The method of claim 17, further comprising:

2                propagating an optical signal through the heat transfer fluid.

1    19. The method of claim 17, further comprising:

2                directing the heat transfer fluid away from the optoelectronic element;

3                cooling the heat transfer fluid; and

4                directing the heat transfer fluid toward the optoelectronic element.

1    20. The method of claim 17, wherein the optoelectronic element is a first

2                optoelectronic element; and

3                further comprising:

4                providing a second optoelectronic element supported by the substrate; and

5                propagating an optical signal through the heat transfer fluid from the first

6                optoelectronic element to the second optoelectronic element.